

## REMARKS

Applicants respectfully request reconsideration of the above-identified patent application pending claims 1-5, 8-10 and 23-28 in view of the foregoing amendment, flowing remarks and evidence of the state of the art teaching away from the claimed invention provided previously-presented Aastrup Declaration. Specifically, applicants have amended claims 1-4 and 25-26 to describe the surface area of the first electrode as a “continuous” surface area. In each instance in the specification, the first electrode surface area is described as a continuous area with such geometric shapes described as a circular electrode or a rectangular (including square) electrode shape. In no instance is a circular electrode described as having inner surfaces or a donut shape or anything similar with a rectangular electrode having an interior hole. Therefore, there is support for this amendment in the consistent specification description of electrode shape as having a continuous surface area without any holes in it. Accordingly, no new matter has been presented. Entry of the foregoing amendment is respectfully requested. Claims 1-5, 8-10 and 23-28 are pending.

### 35 U.S.C. §103 Rejections

Claims 1-5 and 8-10 and 25-28 were rejected as unpatentable under 35 U.S.C. §103 over Thompson et al. (U.S. Patent Application 2003/0076743). It should be noted that the Thompson et al. patent application was abandoned after the first office action as no response was filed so there has never been any examination of whether or not the disclosure is enabled. The Examiner contends that Thompson et al. (paragraph 0043) discloses a TSM sensor and then goes into largely irrelevant detail about TSM sensors, ignoring the crux of the present invention, that is, the limitation in claim 1 “said first crystal surface comprises a first electrode *having a continuous surface area of less than 15 mm<sup>2</sup>*.” (emphasis added). Applicants respectfully traverse this rejection because no matter how much peripheral disclosure may be in Thompson et al. or no matter how many renditions of the Sauerbrey equation may be recited, no *prima facie* showing of obviousness has been made because the Examiner has not shown where Thompson et al. discloses or suggests *each and every claim limitation of the claimed invention*. Therefore, no *prima facie* case of obviousness has been made in this rejection. Accordingly, applicants submit pending claims 1-5, 8-10 and 25-28 are patentable over Thompson et al. because: (1) the Examiner admits that Thompson et al. does not disclose or suggest a key claim limitation in claim 1 (“a continuous surface area of less than 15 mm<sup>2</sup>”), (2) the Examiner has not established a *prima facie* case of obviousness with Thompson et al., and (3) Thompson et al. expressly teaches away from the claimed invention.

In the interest of brevity, applicants shall focus on the first electrode described in its broadest embodiment in claim 1. Claim 1 provides that the first electrode:

1. has a continuous surface area of less than  $15 \text{ mm}^2$ ; and
2. an electrode edge.

Both are required claim limitations. Moreover, dependent claims 2-4 and 25-26 further provide narrower surface area limitations. Further, dependent claims 5-6 and 27-28 further limit the distances from the electrode edge, vis-à-vis the crystal, relating to the second limitation of the first electrode. Therefore, in order to make a *prima facie* case for obviousness, the Examiner must show where in Thompson et al. both first electrode limitations are disclosed or suggested. The Examiner has failed to carry this burden.

1. The Examiner first admits (“Thompson et al. does not specifically disclose quantitative measurements of the electrodes, i.e. the first crystal surface having a first electrode having a surface area of less than  $15 \text{ mm}^2$ ,  $10 \text{ mm}^2$  or  $1-5 \text{ mm}^2$  (as recited in claims 1, 2, 25).”) that Thompson et al. does not disclose the key surface area limitation required in the claimed invention. The Examiner next admits: “Thompson et al. do disclose an electrode that is ‘at least’  $0.05 \text{ mm}^2$  in area (i.e. electrode diameter of 5 mm, thus an area of  $19.63 \text{ mm}^2$ ) as recited in claim 3 (see paragraph 0033).” Unfortunately, this confusing assertion is incorrect. Thompson et al. paragraph 0033 described a purchased commercial electrode that has an area of  $19.63 \text{ mm}^2$  and not “at least  $0.05 \text{ mm}^2$ . This electrode falls outside of the scope of the presently claimed invention. In fact, the specification already discloses commercial electrodes having an area of  $15.9 \text{ mm}^2$  (see Example on pages 17-18 and Figure 8). Therefore, Thompson et al. does not disclose or suggest any electrodes that fall within the limitations in claim 1 herein.

2. The Examiner has gone into detail on the bottom of page 2 and all of page 3 of the present Office Action describing Thompson et al. While applicants respectfully disagree with most of this characterization as being taken out of context, such a discussion is highly tangential and is not needed to address the key issue of this rejection, whether or not the Examiner has established a *prima facie* case of obviousness. In fact, no where does Thompson et al. disclose or suggest the limitation that the continuous surface area of the first electrode is less than  $15 \text{ mm}^2$ . The Examiner admits this and all of the tangential discussion does not change the fact, there is no disclosure or suggestion in Thompson et al. of the key limitations in claim 1.

Undeterred, the Examiner continues: “In particular, Thompson et al. disclose that to *investigate the effect of modification of the electrode geometry* (i.e. total surface area and edge effects) on the sensitivity of the TSM device, disks of 1.5 mm diameter (thus equating to the removal of area of  $1.77 \text{ mm}^2$ ) *were removed* from different locations of the electrode (see paragraph 0043).” (incorrect section with emphasis added). That is a highly misleading characterization of Thompson et al. Instead, Thompson et al. is very clear what it is disclosing.

Thompson et al. states: "Removal of segments of the electrode will increase the edge length, in turn raising the intensity of edge fields, which will enhance the sensitivity of the device." (next paragraph 0044). Therefore, in contrast to the unsupported assertion of the Examiner, Thompson et al. makes its disclosure clear that it is edge effects and only edge effects<sup>1</sup> that is the subject of the Thompson et al. disclosure and not any imaginary surface area characterizations. Thompson et al. does modify its electrode to enhance sensitivity, but Thompson et al. teaches only edge properties and even concludes: "Additionally, by increasing the length of the electrode edges by removing lines and patterns from the electrode surface so that the underlying quartz crystal is exposed, the electrode response is modified." (paragraph 0055).

Therefore, no *prima facie* showing of obviousness has been made by the Examiner by misreading Thompson and adding in thoughts taken in hindsight from the present invention and imagining them in Thompson et al. The Examiner concludes (1) without any support in Thompson et al., and (2) with even the admissions (see above) that there is no support in Thompson et al., that: "It would have been obvious to one having ordinary skill in the art at the time the invention was made<sup>2</sup> to alter the geometry of the electrode(s)." That statement is false. Thompson et al. makes clear that the electrode modification is "to include an enhanced edge region" of the electrode (see, for example, paragraph 0055 last sentence, paragraph 0056 penultimate sentence, paragraph 0047 second sentence, paragraph 0046 first sentence, and paragraph 0021 (summary section) second sentence ("Further, the invention provides a method of enhancing acoustic wave sensor response in a TSM electrode comprising the step of *modifying the electrode to include an enhanced edge region*."(emphasis added))). Accordingly, there is no disclosure or suggestion in Thompson et al. that teaches or suggests the required claim limitation in claim 1 of "a continuous surface area of less than 15 mm<sup>2</sup>." Thus, no *prima facie* case of obviousness can be made.

3. Moreover, in the highly unlikely event that someone can see a *prima facie* case of obviousness, Thompson et al. teaches away from the claimed invention. Specifically, Thompson et al. paragraph 0050 teaches away from the invention of claim 1, by stating: "This is understandable since reducing the size of one of the electrodes causes instability in device resonance." Therefore, the correct conclusion is that one of ordinary skill in the art at the time the invention was made would know NOT TO REDUCE THE SIZE OF THE ELECTRODES

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<sup>1</sup> It should be noted that adding a hole in the electrode made the electrode no longer "continuous" and increases the amount of edge in an electrode, an effect Thompson et al. was seeking.

<sup>2</sup> It appears that this conclusion by the Examiner refers to what would and would not have been obvious to one of ordinary skill in the art at the time the invention was made applies only to Thompson et al. and Josse et al. but inexplicably, does not apply to the three references (Lu et al. I, Lu et al. II and Wu et al.), cited in the Aattrup Declaration made of record herein. That highly selective consideration of what would and would not have been obvious to one of ordinary skill in the art at the time the invention was made is highly improper.

because Thompson et al. teaches that such a modification causes problems for device performance. **Therefore, Thompson et al. expressly teaches away from the claimed invention.** The Examiner must consider this evidence in Thompson et al. as a key secondary consideration of patentability of the presently claimed invention.

Accordingly, claims 1-5, 8-10 and 25-28 are patentable over Thompson et al. because: (1) the Examiner admits that Thompson et al. does not disclose or suggest the key claim limitation in claim 1 (“a continuous surface area of less than 15 mm<sup>2</sup>”), (2) the Examiner has not established a *prima facie* case of obviousness with Thompson et al., and (3) Thompson et al. expressly teaches away from the claimed invention.

### Second Rejection

Claims 1-5 and 8-10 and 25-28 were rejected as unpatentable under 35 U.S.C. §103 over Josse et al. (U.S. Patent 5,852,229). This rejection was based on the Examiner’s unsupported assertion that Josse et al. somewhere, somehow suggests that changing (but without indicating which way or how) electrode size will impact sensitivity. The Examiner again admits that Josse et al. does not disclose or suggest the limitation of claim 1 (“a continuous surface area of less than 15 mm<sup>2</sup>”), but instead somehow dances around this issue by stating: “Although Josse et al. does not disclose specific quantitative surface areas of the electrode(s), that is, specific dimensional/geometric aspects of the electrodes(s) (i.e. surface area <15 mm<sup>2</sup> or 10 mm<sup>2</sup> or is 1-5 mm<sup>2</sup> or the distances between the crystal edge and the electrode edge being at least 0.2 mm or 1 mm or 2 mm) (as recited in claims 1-3, 5 and 25-28), Josse et al. does carefully teach and explain that ‘conductivity of the loading medium results in the expansion of the effective electrode surface area, and that the electrode regions and their electrostatic capacitance is a result of the electrode size, shape and configuration, in other words, the electrode surface area.’” In view of that sentence and the need for so many words to both admit that the two key claim limitations for the first electrode are nowhere found in Josse et al. and then try to dance around that fact with loads of unsupported tangential statements, applicants respectfully traverse this rejection because: (1) the Examiner admits that Josse et al. does not teach or suggest the claimed invention because Josse et al. does not disclose or suggest required claim limitations; (2) the Examiner has not established a *prima facie case* of obviousness by admitting that Josse et al. does not teach or suggest the key surface area limitation found in claim 1 (let alone claims 2-3); (3) the Aastrup Declaration provides EVIDENCE THAT MUST BE CONSIDERED AND NOT IGNORED showing that the art that is roughly contemporaneous with the present invention expressly taught away from the claimed invention, and now Thompson et al. (see-above) also teaches away from the claimed invention, together providing more-than-sufficient secondary considerations to support the patentability of the claimed invention; and (4) the Examiners “Response to Arguments” section on

pages 7-10 of the current Office Action is setting up a straw man bearing no relation to the issue of patentability of the claimed invention and is refuted herein, point-by-point, in the order presented.

1. The Examiner admits that Josse et al does not teach or suggest the claimed invention because Josse et al. does not disclose or suggest the claim limitations. Claim 1 provides that the first electrode:

1. has a continuous surface area of less than  $15 \text{ mm}^2$ ; and
2. an electrode edge.

Both are required claim limitations. Moreover, dependent claims 2-4 and 25-26 further provide narrower surface area limitations. Further, dependent claims 5-6 and 27-28 further limit the distances from the electrode edge vis-à-vis the crystal, relating to the second limitation of the first electrode.

Therefore, in order to make a *prima facie* case for obviousness, the Examiner must show where in Josse et al. both first electrode limitations are disclosed or suggested. Instead of actual evidence or even teachings in Josse et al., the Examiner makes it up by stating: "It is well known in the art that the variations in electrode structure (i.e. total mass and/or area) can increase the sensitivity of the resonator, the ability to sense a variety of materials of interest and the ability to determine concentration of one or more materials of interest." (sentence spanning Office Action pages 5-6). That unsupported (in Josse et al.) sentence is **incorrect**, is **contradicted** by the evidence in the specification (see, for example, the Example on pages 17-19), and is **contradicted** by the contemporaneous references provided in the Aastrup Declaration. For example, in the Example provided in the specification (pages 17-19) the applicants show the surprising and unexpected results of frequency change (see Figure 8) with a smaller crystal ( $4 \text{ mm}^2$ ) than a commercial standard electrode ( $15.9 \text{ mm}^2$ ). Where does Josse et al. teach or suggest that? The fact remains Josse et al. does not teach or suggest making electrodes smaller to improve sensitivity (i.e., frequency). If making electrodes having a continuous surface area of less than  $15 \text{ mm}^2$  was so "well known in the art" as the Examiner alleges, why cannot the Examiner actually find such a teaching? Perhaps the specific smaller size was so counter-intuitive that it was not only NOT well known in the art but is a surprising result. A surprising result, as provided in the Example in the specification, is an important secondary consideration of non-obviousness that **MUST BE CONSIDERED BEFORE** a conclusion of obviousness is reached. The references that teach away from the notion of making the electrode smaller to improve sensitivity are also important secondary considerations that **MUST BE CONSIDERED BEFORE** a conclusion of obviousness is reached. Moreover, the Thompson et al. reference that the Examiner found also teaches away from the claimed invention (see above). Thus, Thompson et al. is yet another example of a reference that teaches away from the notion of making the electrode smaller to improve

sensitivity. All are also important secondary considerations that **MUST BE CONSIDERED BEFORE** a conclusion of obviousness is reached. Accordingly, we now have (a) surprising results in the specification, (b) three references in the Aastrup Declaration that teaches away from the claimed invention, and (c) the Thompson et al. references that teaches away from the claimed invention all provided herein as evidence versus the Examiner's unsupported, conclusory statement ("It is well known in the art that the variations in electrode structure (i.e. total mass and/or area) can increase the sensitivity of the resonator, the ability to sense a variety of materials of interest and the ability to determine concentration of one or more materials of interest. "). Applicants respectfully urge the Examiner to finally throw in the towel on this one and withdraw this rejection.

2. The Examiner has admitted that Josse et al. does not teach or suggest the key surface area limitation found in claim 1. This, in and of itself, is evidence that the Examiner has not established a *prima facie* case of obviousness. But the Examiner even admits that Josse et al. does not teach or suggest the two key limitations in claim 1. Applicants do not even need to respond to such an admission except to simply respectfully request that this rejection be withdrawn because, by the Examiner's own admission, he lacks the facts to support a *prima facie* case of obviousness.

3. The Aastrup Declaration provides evidence showing that the art that is roughly contemporaneous in time with the present invention expressly taught away from the claimed invention. In the present Office Action, the Examiner does not address the Aastrup Declaration or any of the evidence presented therein. The Aastrup Declaration stands uncontroverted and of record herein. Therefore, in view of the evidence of teaching away from the claimed invention provided in the Aastrup Declaration, applicants respectfully request withdrawal of this rejection.

4. The "Response to Arguments" section on pages 7-10 of the Office Action does not provide any evidence to support *prima facie* obviousness and does not provide any case law that supports the conclusions based on the present set of facts. The Examiner now alleges that Josse et al. coupled with the Sauerbrey equation somehow suggests that a person of ordinary skill in the art would magically come up with the two limitations of claim 1 (to wit: "has a continuous surface area of less than 15 mm<sup>2</sup>," and "an electrode edge"). Firstly, it should be noted that applicants cited to the Sauerbrey equation in the specification (see page 8, second full paragraph), but then showed the surprising results in the Example in the specification, results that were not taught or suggested by reference to the Sauerbrey equation or to Josse et al. Secondly, since a person of ordinary skill in the art would be aware of the Sauerbrey equation, why didn't Lu et al. I, Lu et al. II or Wu et al. figure out that one needed a first electrode surface area less than 15 mm<sup>2</sup>?<sup>3</sup> The

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<sup>3</sup> These three references were provided in the Aastrup Declaration.

answer (that the Examiner has thus far failed to admit) is that the present invention is counter-intuitive and surprising, an important secondary consideration of patentability.

It is important to note that the Examiner only alleges that one alters the geometry of the electrode and not what happens when one alters the geometry. Thompson et al. (cited herein) also alters the geometry by drilling holes in electrodes. Therefore, “altering the geometry” as the Examiner indicates may be suggested does not teach or suggest specific surface areas that show surprising results (see Figure 8 in the specification).

Applicants have not “stated” that there are surprising and unexpected results, applicants have shown them (see Example in specification, Figure 8). Applicants have satisfied their burden and have supported their statements. Again, Lu et al. I, Lu et al. II and Wu et al. have all taught away from the claimed invention and they are also persons of ordinary skill in the art aware of the Sauerbrey equation. That evidence, in and of itself, shows that the Examiner’s assertions are unsupported and contrary to the evidence of record herein. More importantly, the Aastrup Declaration provided evidence of secondary considerations that must be considered and not dismissed, because it does not fit in with the Examiner’s unsupported theory of what a person of ordinary skill in the art *would* do. We have actual evidence of what such people of ordinary skill in the art *actually did do*<sup>4</sup>.

The Examiner then provides a long litany of case law. But none of the citations, particularly *KSR*, describe the present situation where the only evidence of record shows unexpected and surprising results *plus* evidence of other references teaching away from the claimed invention. Those facts alone distinguish *KSR* and its progeny and all of the case law cited by the Examiner. In fact, the Federal Circuit in a decision (*Eisai Co. Ltd. v. Dr. Reddy’s Laboratories, Ltd, and Teva Pharmaceuticals USA, Inc.* Fed. Cir. 2007-1397,-1398, decided 21 July 2008) released after the present Office Action interpreted how *KSR* should be applied:

In *KSR*, the Supreme Court noted that an invention may have been obvious “[w]hen there [was] . . . a design need or market pressure to solve a problem and there [were] . . . a finite number of identified, predictable solutions.” 127 S. Ct. at 1742 (tense changes, 492 F.3d at 1357 (“Thus, in cases involving new chemical compounds, it remains necessary to identify some reason that would have led a chemist to modify a known compound in a particular manner to establish prima facie obviousness of a new claimed compound.”). Third, the Supreme Court’s analysis is supplied to clarify, as the Court stated and as per 35 U.S.C. § 103, that the obviousness inquiry must rely on evidence available “at the time” of the invention, *see Takeda*, 492 F.3d at 1356 n.2). The Supreme Court’s analysis in *KSR* thus relies on several assumptions about the prior art landscape. First, *KSR* assumes a starting reference point or points in the art, prior to the time of invention, from which a skilled artisan might identify a problem and pursue potential solutions.

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<sup>4</sup> And the evidence shows that the Examiner’s prediction was not correct.

Second, *KSR* presupposes that the record up to the time of invention would give some reasons, available within the knowledge of one of skill in the art, to make particular modifications to achieve the claimed compound. See *Takeda*. *KSR* presumes that the record before the time of invention would supply some reasons for narrowing the prior art universe to a “finite number of identified, predictable solutions,” 127 S. Ct. at 1742. In *Ortho-McNeil Pharmaceutical, Inc. v. Mylan Laboratories, Inc.*, 520 F.3d 1358, 1364 (Fed. Cir. 2008), this court further explained that this “easily traversed, small and finite number of alternatives . . . might support an inference of obviousness.” To the extent an art is unpredictable, as the chemical arts often are, *KSR*’s focus on these “identified, predictable solutions” may present a difficult hurdle because potential solutions are less likely to be genuinely predictable.

In summary, evidence of secondary considerations (in this case both surprising results and teaching away from the claimed invention) must be considered before a conclusion of obviousness is reached and no case law can change the facts and evidence of record herein.

Accordingly, (1) applicants have met their burden of providing evidence to support patentability, (2) the Examiner has admitted to a lack of evidence and no teachings or suggestions in Josse et al. and (3) the Examiner has not met his burden to support *prima facie* obviousness. In view of the facts and evidence of record herein, applicants respectfully request withdrawal of this rejection.

In view of the foregoing amendment, remarks, Aastrup Declaration, and the entire file history, applicants respectfully request allowance of claims 1-5, 8-10 and 23-28.

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